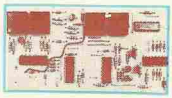
TALKING ELECTRONICS®

HELPS YOU UNDERSTAND ELECTRONICS

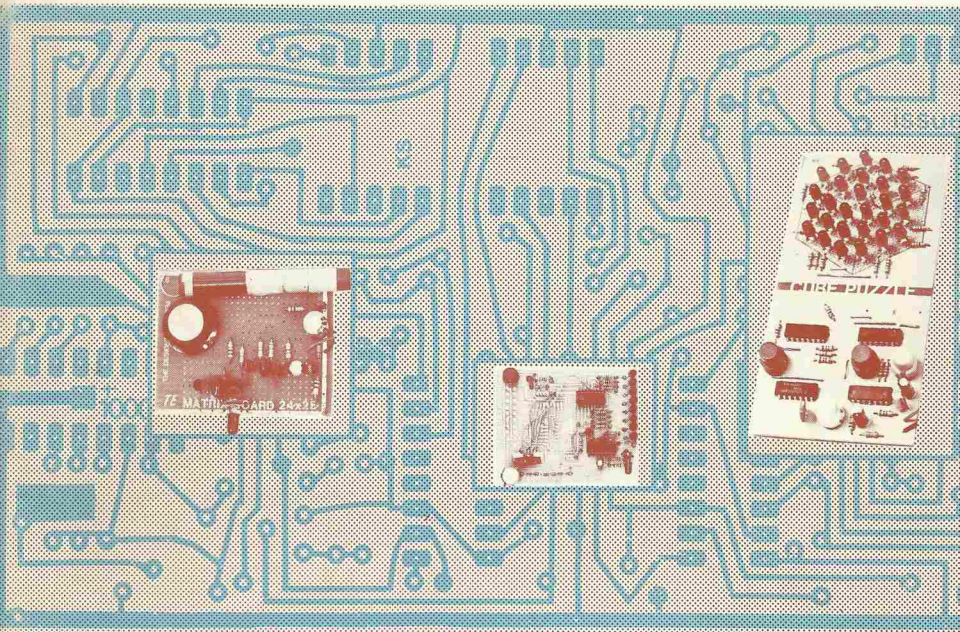
$3.75★

N.Z. $5.00

DIGITAL CLOCK



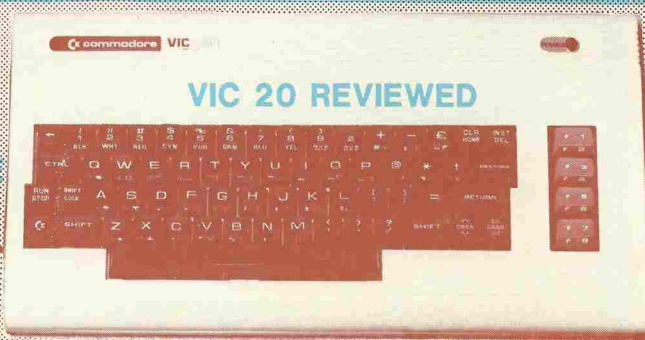
Issue No 8



CUBE PUZZLE

IC RADIO

PROGRAMMABLE LIGHT CHASER



TALKING ELECTRONICS

Vol. 1. No. 8.

Editorial...

The layout of magazines has always amazed me. Have you noticed how they present all the best material in the first half and as you pass the half-way mark, the quality deterioriates to a miserable conclusion.

Take an opposite. A movie film. Imagine if a film maker started with a grand opening and as the movie progressed, the story-line became weaker and weaker and weaker. It doesn't happen because the film maker is intent on selling the product to scrutineering eyes. He has to sell to a very critical distributor as well as take the brunt of criticism from film critics.

This isn't the case with magazines. In fact it is quite the opposite. The realities are quite disturbing. If you thumb through any of a dozen magazines, you will see what I mean. The colour is concentrated towards the front, the editorial matter is heavy at the commencement and the quality of the paper is superb at the beginning. Everything seems to deterioriate as the page numbers increase. Have you ever thought "Why is this so?" Have you ever contemplated the main factor which sells a magazine?

If you think it's the editorial or the main articles, you will be wrong. The main drawcard is the advertisements. The brightly coloured eye-catching trivia of the ad agencies. And the proof is easy to demonstrate.

A magazine containing 60% advertising will sell faster and in greater quantities than a spin-off consisting solely of editorial matter. And this is most disappointing.

Subconsciously we tend to gravitate towards the promotional material more than looking for substance in the text.

If we take the specific case of electronic magazines, this situation has allowed the technical sections of many magazines to become complacent to the extent that they can present less material per issue than ten years ago. All in an era when electronics is expanding five times faster than a decade ago!

One magazine in England has endevoured to reverse this trend. Edited by Ray Marston, it has successfully increased its number of pages in the seventh issue and is currently providing the best ratio of technical material to advertising. On the home front, I think we are providing a fair example of what should be done for the hobbyist. I do not want to include any more advertising than absolutely necessary to provide a back-up for the constuction of the projects. Too often these advertisements date a magazine and within a month or so, the January specials are stale. Even our first issue still has the same demand for projects as it did a year ago. Basic electronics and theory do not date. It will still be true and current five or ten years from now. Let's hope we are still here to demonstrate it.

Colin Mitchell.

TECHNICAL
Ken Stone

ARTWORK
Paul O'Callaghan

ENQUIRIES
10 Minute queries will be answered on 584 2386

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INDEX

Rosemary Socic of Sandringham Technical School didn't solve our CUBE PUZZLE but hasn't given up yet.

TE Clock

Ideal for your workshop or beside your bed, this illuminated clock can be read by day or night. It will help you run to time.

Our cover feature is a clock. A simple every-day timepiece. Something we think very little about. Most of us have a clock in at least two rooms of the house and at least one of these will be digital. If not, you will be particularly interested in our project. If you already have a digital clock, you will appreciate the advantage of an illuminated dial.

One hundred years ago, the purchase of a time-piece was a great decision. Miniature clocks and watches were enormously expensive and necessitated careful decision as to the most suitable model and the relative costs.

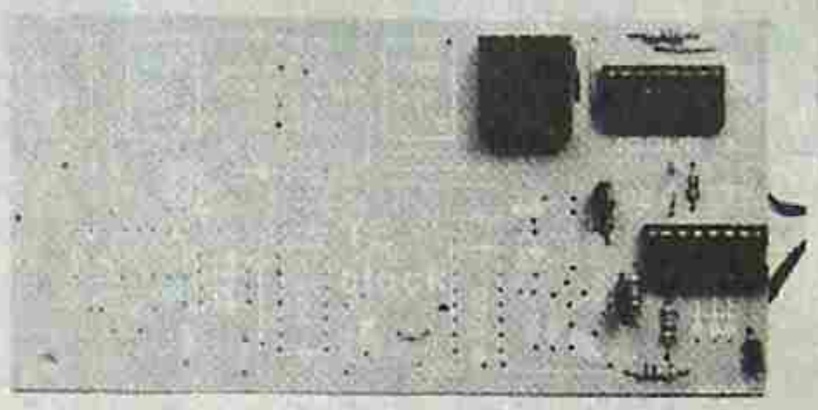
Clocks have always been an item of great beauty. If you have ever wandered through the clock section of a museum you will appreciate the aesthetic designs which have been in-corporated into the face and even the workings of many clocks and watches.

This is the only mechanical product I can recall where the workings have been specifically designed to be ornate as well as being fully functional.

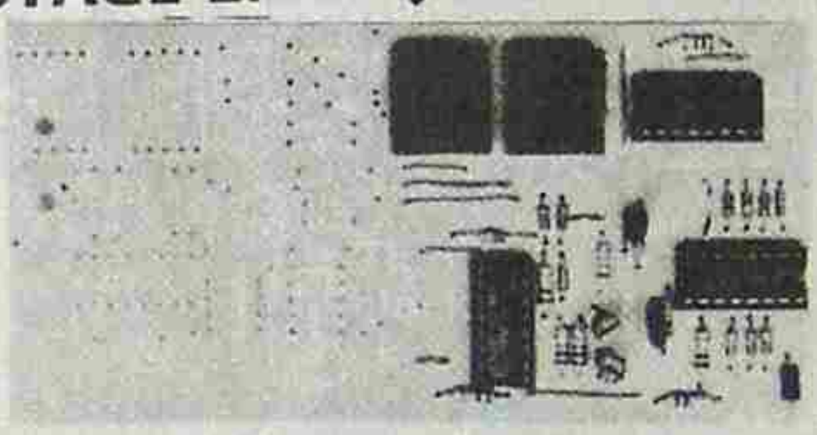
From the beginning of time, man has strived to produce a more accurate time keeper. From the simple time-candle, to the atomic clock, we have seen the introduction of one improvement after another. As you are possibly aware, the biggest threat to accurate time keeping has always been temperature. The variation between hot and cold expands and contracts all materials such that a pendulum will increase in length on a hot day with the effect that it will swing at a slower rate. Some form of temper-ature compensation is required which will alter the distributed mass of the pendulum and keep its centre of gravity constant. Once this was achieved, the next major breakthrough was the balance wheel. This enabled pendulums to be incorporated into pocket watches where the pendulum needed to be compact and placed in any position and still function. Again, temp-erature compensation had to be included in the form of two bonded metals on the rim to expand or contract the arms of the balance wheel. Static and dynamic balancing was also an essential part of accuracy and for a tiny set of screws was placed on the rim of the balance wheel. Needle point bearings and jewels were added to reduce friction and for 30 years the Swiss engineers had the watch market sewn up.

The clock is constructed in 4 stages. Each stage adds a display to the board. After completing each stage with its associated driving components, the clock is tested. This will reduce the chance of a mistake and make troubleshooting very easy. . . .if required.

STAGE 1:



STAGE 2:



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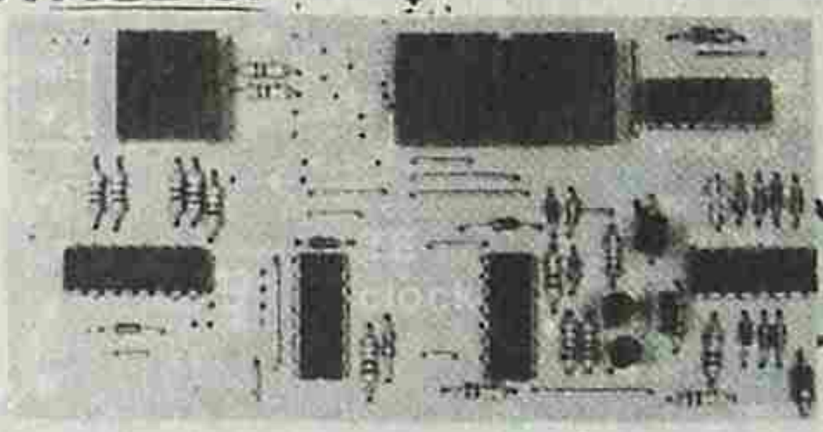
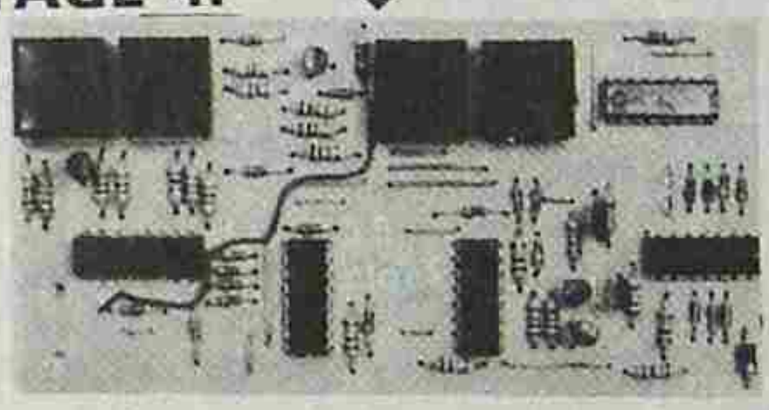


STAGE 4:



An AC plug pack of 100 - 300mA rating powers the clock. Don't use a DC plug pack as we need the AC to trigger the 4040 counter chip. The ripple from the DC plug pack would not be sufficient.

A partial threat came with the introduction of electronic watches using a tuning fork principle and an enormous chain of gears to divide down the vibration of the resonating arm.

It was not until the introduction of digital electronics and its miniaturization due to the US space program, that the wind-up watch market crashed.

Every-one likes new and potentially more-accurate devices. The consumer abandoned his old watch for one of these new electronic wonders. Initially they were LED displays and needed a switch to illuminate the dial. This worked well for a while but if your required to know the time more than once per day, the battery life was severely limited.

The introduction LCD displays and a one year battery life cured that. You could now get a watch having an accuracy of .1 second per month, for less than a wind-up style. Additionally the watch would run for about a year on one set of batteries and had an extra feature of day, date and alarm. Some even boasted dual time zones and stop-watch facilities, all at a price below that of 10 years ago.

It's no wonder digital watches took off.

For a construction project, there is one obstacle to producing a digital watch or clock. Most of the chips used in these products are designed especially for a partcular function and no technical knowledge is to be gained by soldering a single chip into a circuit.
On the other hand, if we produce a clock circuit using a purely digital approach, the number of chips required make construction very costly.

So some form of compromise has to be made. The readout can still be digital but the method by which some of the digital stages operate will have to be simplified with a few tricks. By bending the rules a little, we can produce a digital clock with as few as 5 chips. And this is what we have done. We have used transistors for some of the operations.

Before constructing this project, you must have completed at least three other projects from TE or other magazines. There are two main reasons for this.
1. It will ensure only those capable of constructing a project of this complexity, do so
2. It will spread out the construction of the clock over a longer period of time to allow everone to buy the components. This is important as some of the IC's are in relatively short supply.

It does not matter which three projects you have constructed however the inclusion of the LOGIC DESIGNER will be an advantage since it will be used in the testing of each stage.

USING CD 4033's

If you experience difficulty obtaining CD 4026 IC's, a replacement in the form of CD 4033 can be used.

The only modification to the board is at pin 14. It must be taken LOW to prevent the display showing a figure 8 at all times. Pin 14 is the LAMP TEST pin and when it is taken HIGH, it presents an output on all segments to test if they are all operating.

The other difference between the chips is pin 3. The 4033 provides ripple blanking at pin 3 which can be used to suppress unwanted zero's at the beginning of decimal numbers. With suppression, a number such as 00.05 would be shown as 0.05. This line is held HIGH for normal operation as is the display enable of the 4026. Therefore no modification is needed to the PC board.

In place of the Display Enable out, pin 4 is Ripple Blanking out. AS the display enable out is not connected in the project, no modification is needed at this pin.

PARTS LIST

1 - 220R
7 - 470R
1 - 2k7
5 - 10k
6 - 100k
1 - 330k
1 - 470k
2 - 1M

2 - 10n greencap
1 - 1000mfd 25v electro

1 - 1N 4001 diode
22 - 1N 914 diode

3 - BC 547 transistors
1 - BC 557 transistor

4 - FND 500 display

2 - CD 4026 (or CD 4033 with mod)
1 - CD 4040 binary counter IC
1 - CD 4511 display driver IC
1 - CD 4518 dual BCD counter IC

tinned copper wire
Plug pack 9v AC 200mA
TE CLOCK PC BOARD